

WHAT IS CLAIMED IS:

1. An air-bubble-monitoring medication assembly comprising:
 - a) a drug infusion subassembly having a tube for administering therein a liquid to a patient;
 - b) a bubble-size determinator which is disposed to sense an air bubble above a minimum size entrained in the liquid in the tube and which determines the volume of the sensed air bubble; and
 - c) an analyzer which logs the time the bubble-size determinator senses an air bubble and the volume of the sensed air bubble, which calculates a first running sum of a total air volume of all air bubbles sensed over a first time interval, which compares the first running sum with a first preselected limit, and which generates an output when the first running sum exceeds the first preselected limit.
2. The air-bubble-monitoring medication assembly of claim 1, wherein the analyzer: calculates a second running sum of a total air volume of all air bubbles sensed over a second time interval; compares the second running sum with a second preselected limit; and generates the output when the second running sum exceeds the second preselected limit, wherein the second time interval is longer than the first time interval, wherein the second preselected limit equals the first preselected limit times a multiplier, and wherein the second time interval does not equal the first time interval times the multiplier.
3. The air-bubble-monitoring medication assembly of claim 1, wherein the output is a shut-down signal indicating that the drug infusion subassembly is to be shut down and/or an alarm signal indicating that a total bubble size limit has been exceeded.
4. The air-bubble-monitoring medication assembly of claim 1, wherein the first time interval is a first predetermined fixed interval.

5. The air-bubble-monitoring medication assembly of claim 1, wherein the drug infusion subassembly administers the liquid at a selectable dose rate, and wherein the first time interval depends on the selected dose rate.
6. The air-bubble-monitoring medication assembly of claim 5, wherein the analyzer uses a smaller first time interval for a higher selected dose rate and uses a larger first time interval for a lower selected dose rate.
7. The air-bubble-monitoring medication assembly of claim 1, wherein, when the drug infusion subassembly has started administering the liquid for a time less than the first time interval, the analyzer calculates an initial sum of a total air volume of all air bubbles sensed up to the first time interval, compares the initial sum with the first preselected limit, and generates the output when the initial sum exceeds the first preselected limit.
8. The air-bubble-monitoring medication assembly of claim 1, wherein the tube is an intravenous tube.
9. The air-bubble-monitoring medication assembly of claim 1, wherein the liquid includes a conscious sedation drug.
10. The air-bubble-monitoring medication assembly of claim 9, wherein the drug infusion subassembly administers the liquid at a selectable dose rate selected at least in part according to a determined level of sedation of the patient.
11. A medical system comprising:
 - a) an air-bubble-monitoring medication assembly including:
 - 1) an intravenous drug infusion subassembly having a tube for administering therein a liquid to a patient;

2) a bubble-size determinator which is disposed to sense an air bubble above a minimum size entrained in the liquid in the tube and which determines the volume of the sensed air bubble; and

3) an analyzer which logs the time the detector senses an air bubble and the volume of the sensed air bubble, which calculates a first running sum of a total air volume of all air bubbles sensed over a first time interval, which compares the first running sum with a first preselected limit, and which generates an output when the first running sum exceeds the first preselected limit; and

b) a controller assembly which determines a delivery schedule including a current dose rate for administering the liquid and which controls the drug infusion subassembly to administer the liquid in accordance with the determined delivery schedule.

12. The medical system of claim 11, wherein the analyzer: calculates a second running sum of a total air volume of all air bubbles sensed over a second time interval; compares the second running sum with a second preselected limit; and generates the output when the second running sum exceeds the second preselected limit, wherein the second time interval is longer than the first time interval, wherein the second preselected limit equals the first preselected limit times a multiplier, and wherein the second time interval does not equal the first time interval times the multiplier.

13. The air-bubble-monitoring medication assembly of claim 11, wherein the output is a shut-down signal indicating that the drug infusion subassembly is to be shut down and/or an alarm signal indicating that a total bubble size limit has been exceeded.

14. The air-bubble-monitoring medication assembly of claim 11, wherein the drug infusion subassembly administers the liquid at a selectable dose rate, and wherein the first time interval depends on the selected dose rate.

15. The air-bubble-monitoring medication assembly of claim 11, wherein, when the drug infusion subassembly has started administering the liquid for a time less than the first time interval, the analyzer calculates an initial sum of a total air volume of all air bubbles sensed up to the first time interval, compares the initial sum with the first preselected limit, and generates the output when the initial sum exceeds the first preselected limit.

16. The air-bubble-monitoring medication assembly of claim 11, wherein the liquid includes a conscious sedation drug, and wherein the drug infusion subassembly administers the liquid at a selectable dose rate selected at least in part according to a determined level of sedation of the patient.

17. A method for monitoring air bubbles in a drug infusion subassembly having a tube for administering therein a liquid to a patient, wherein the method comprises the steps of:

- a) disposing a bubble-size determinator to sense the presence of an air bubble above a minimum size entrained in the liquid in the tube, wherein the bubble-size determinator also determines the volume of the sensed air bubble;
- b) logging the time the bubble-size determinator senses an air bubble and the volume of the sensed air bubble determined by the bubble-size determinator;
- c) calculating a first running sum of a total air volume of all air bubbles sensed over a first time interval;
- d) comparing the first running sum with a first preselected limit; and
- e) generating an output when the first running sum exceeds the first preselected limit.

18. The method of claim 17, also including the steps of:

- f) calculating a second running sum of a total air volume of all air bubbles sensed over a second time interval;
 - g) comparing the second running sum with a second preselected limit;
- and

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h) generating the output when the second running sum exceeds the second preselected limit, wherein the second time interval is longer than the first time interval, wherein the second preselected limit equals the first preselected limit times a multiplier, and wherein the second time interval does not equal the first time interval times the multiplier.

19. The method of claim 17, wherein the output is a shut-down signal indicating that the drug infusion subassembly is to be shut down and/or an alarm signal indicating a total bubble size limit has been exceeded.

20. The method of claim 17, wherein the drug infusion subassembly administers the liquid at a selectable dose rate, and wherein the first time interval depends on the selected dose rate.